DOE/NSF Project Manager's Quarterly Progress Report
U.S. Large Hadron Collider Project

1. PROJECT IDENTIFIERS

Reporting Period:	Through **March 31, 1998**
Program Sponsors:	DOE Division of High Energy Physics/NSF Physics Division
DOE/NSF Program Manager:	T. Toohig, (301) 903-4115, timothy.toohig@science.doe.gov
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2. PROJECT DESCRIPTION

The Department of Energy (DOE) and the National Science Foundation (NSF) have signed agreements committing to collaboration in the construction of the Large Hadron Collider (LHC) at CERN (European Laboratory for Particle Physics) and two of its associated detectors. The U.S. fabrication effort will be carried out at, or under the supervision of, U.S. universities and national laboratories under the terms and conditions described in the International Collaboration Agreement (Agreement) and its Accelerator and Experiments Protocols. The U.S. LHC Project is defined by the goods and services to be provided to CERN under the terms of the Agreement between DOE, NSF, and CERN. These goods and services include DOE contributions to the LHC accelerator, and DOE and NSF contributions to the ATLAS (A Toroidal LHC Apparatus) and CMS (Compact Muon Solenoid) experiments.

The DOE contribution to the LHC accelerator consists of items provided by DOE National Laboratories and CERN direct purchases from U.S. industrial firms. The scope of these contributions is addressed in the Accelerator Protocol and described in detail in an Implementing Arrangement between the collaborating DOE National Laboratories and CERN. The DOE and NSF contributions to the ATLAS and CMS detectors consist of items supplied by the collaborating U.S. universities and DOE National Laboratories. The scope of these contributions is addressed in the Experiments Protocol and described in detail in Memoranda of Understanding for collaboration on construction of each experiment.

The U.S. LHC Project includes the U.S. ATLAS, U.S. CMS, and U.S. LHC Accelerator projects. This report summarizes the overall status of the U.S. LHC Project effort and includes status specific to each sub-project. Additional information can be accessed at the following web sites:

U.S. LHC Project - http://www.hep.net/doe-hep/lhc.html

LHC Project - http://wwwlhc.cern.ch/	U.S. LHC Accelerator - http://www-td.fnal.gov/
ATLAS - http://atlasinfo.cern.ch/Atlas/Welcome.html	U.S. ATLAS - http://www.usatlas.bnl.gov/
CMS - http://cmsinfo.cern.ch/Welcome.html	U.S. CMS - http://uscms.fnal.gov/

3. PROJECT MANAGER'S NARRATIVE HIGHLIGHTS

A listing of current project reviews and status meetings is shown below:

Project	Event	Date
U.S. LHC Accelerator	DOE/NSF Review	April 8, 1999
U.S. ATLAS	DOE/NSF Review	May 6, 1999
U.S. CMS	Quarterly Status Meeting	May 19, 1999
U.S. LHC Accelerator	Quarterly Status Meeting	July 13, 1999
U.S. ATLAS	Quarterly Status Meeting	August 6, 1999
U.S. CMS	DOE/NSF Review	August 19, 1999

The results of these activities are documented in formal reports and meeting notes. The U.S. CMS and U.S. ATLAS projects submit monthly cost and schedule performance data to DOE/NSF and the U.S. LHC Accelerator project submits a quarterly report. Current performance data is summarized below.

Table 3.1, Contingency Status (in thousands of dollars)[*]

U.S. Activity	Total Project Cost TPC	Budget at Completion BAC	Contingency	BCWP	BAC-BCWP	Contingency/ BAC-BCWP (%)
ATLAS[†]	163,750	100,056	43,918	14,955	85,101	51.6
CMS	167,250	111,787	48,543	32,268	79,519	61.0
Accelerator	110,000	91,455	18,545	26,692	64,763	28.6

Table 3.2, Schedule Performance Indices[‡]

	Planned Complete (%)	Actual Complete (%)	Schedule Performance
U.S. ATLAS	17.5	14.9	0.85
U.S. CMS	30.9	28.9	0.93
U.S. LHC Accelerator	33.0	29.2	0.88

Contracts for materials are typically within estimates and contingency is adequate. The projects are transitioning into a production and fabrication phase. During this phase experience on production and labor costs will be an important indicator of cost performance. Schedule performance is measured through milestone completion and by earned value (budgeted cost of work performed). These measurements indicate that schedule progress is slightly behind plans.

[*] BCWP = Budgeted Cost of Work Performed. BAC = Budget at Completion.
[†] The Budget at Completion for U.S. ATLAS excludes $19,776k for items that have no cost risk or capped.
[‡] Planned complete = Budget Cost of Work Scheduled (BCWS)/Budget At Completion (BAC). Actual complete = BCWP/BAC. Schedule performance = BCWP/BCWS.

4. PROJECT MANAGER'S ASSESSMENT

Overall Assessment - Satisfactory. The project technical, cost, and schedule baselines are approved and subject to formal change control procedures. All projects are reporting status against the approved baselines. The U.S. ATLAS and CMS groups are meeting their project goals and are reliable and influential partners in the ATLAS and CMS collaborations. There is a strong relationship between the U.S. labs and CERN on the machine with good success resolving interface issues.

Cost - Project reviews and reports continue to confirm that the projects have appropriate cost and contingency estimates. Cost performance is in accordance with plans with very limited use of contingency.

Schedule - CERN plans to complete construction of the LHC and commence initial operations in 2005. The baseline schedules are generally consistent with the ATLAS, CMS, and LHC schedules. There are a few cases where our schedules are not consistent with the required dates in the CERN "official" installation schedules. These inconsistencies are understood and are being addressed by CERN and the U.S. collaborators. Near term schedule progress is satisfactory, typically within fifteen percent of the approved plan.

Technical - Considerable effort was directed at defining a set of U.S. deliverables to CERN that we are confident can be realized, given the planned funding. The U.S. ATLAS, U.S. CMS, and U.S. LHC Accelerator projects have each developed a separate list of deliverables that has been formally accepted by CERN, and the DOE/NSF Joint Oversight Group. We expect to fulfill our commitments to CERN and hope that additional items can be provided to CERN, within the approved funding, should cost performance be favorable.

Issues

Russian Collaborators - Russian collaborators continue to face severe difficulties due to the financial crisis in Russia. CERN and the international ATLAS and CMS management are actively monitoring this issue in order to mitigate impacts on the LHC program. Since some of the U.S. ATLAS and U.S. CMS detector activities are dependent on Russian collaborators, U.S. managers are actively evaluating contingency plans to assure that the U.S. deliverables are not adversely impacted by the funding situation in Russia.

ATLAS and CMS Schedules - The U.S. ATLAS and CMS detector efforts are dependent on progress of their international counterparts. There are instances where delays in the international ATLAS and CMS experiments have caused adverse schedule impacts to the U.S. activities. These types of issues continue to be addressed on a case-by-case basis.

ATLAS Integration – The resources available for ATLAS integration engineering are insufficient to meet the detectors schedule and technical assurance requirements. U.S. ATLAS management has raised this issue with the ATLAS Spokesperson and CERN management.

5. NARRATIVE SUMMARY

5.1 DETECTORS

U.S. ATLAS

ATLAS International – The Technical Co-ordination Technical Design Report was completed and presented to the LHC Committee. The document covers general project planning and follow-up, the many aspects of overall integration of the subsystems, and all the infrastructure and logistics aspects of the ATLAS experiment. ATLAS has established three types of internal reviews: strategic system reviews, design reviews, and production readiness reviews. In addition to the reviews ATLAS has established internal milestones (more than 1000) which are used as a project tracking tool. The ATLAS Spokesperson has analyzed the schedule and identified areas where corrective action is necessary.

U.S. ATLAS - A quarterly status meeting was held in January. The project is making good progress and is approximately 15% complete. Recent accomplishments in selected U.S. ATLAS subsystems is summarized below:

Silicon Strip and Pixel Detectors

- Excellent progress on the pixels with substantial improvements in post-irradiation performance.
- Completed simulation studies of silicon strip readout electronics to be used for comparison with experimental results.

Transition Radiation Tracker Detector

- Established assembly sites at Hampton, Duke, and Indiana University.
- Completed wire stringing for the third production prototype.

Liquid Argon Electromagnetic Calorimeter

- Barrel Cryostat – Fabrication efforts at Kawasaki continue on schedule. Developed a plan for transporting the cryostat to CERN.
- Feedthroughs – Addressed concerns performance of contacts by implementing low cost design changes (gold-plated contacts and glass insulated pin carriers).
- Motherboards – Production is on hold pending resolution of the Kapton electrodes. Design changes implemented to improve cross-talk performance.
- Front End Board – Fully functional front end boards were tested on the bench and at the test beams at CERN. The performance of the boards has been very good. The design will be implemented more fully in the radiation tolerant electronics.
- System Crate – The first two system prototypes were installed and tested in the CERN test beam. Performance was good and supports completing the design of the crate, pedestal and low power bus.

Scintillator – Tile Hadronic Calorimeter

- Started production of submodules at Argonne National Laboratory and the University of Chicago.
- Completed fabrication of the scintillator sleeves.

Muon Tracking Detectors

- Completed assembly of the prototype drift tube chamber providing an important validation of production processes and rates.
- Increased engineering efforts in support of production plans.

Trigger and Data Acquisition Subsystems

- Conducted performance studies in support of the design of the level 2 trigger.

U.S. CMS

CMS International - The CMS Technical Design Reports are complete for all detector systems except the Trigger/Data Acquisition and all are approved by the LHCC. Over fifty percent of the estimated costs of the solenoid magnet have been awarded to vendors. The collaboration has adopted a Steering Committee that is a compact group of top level managers charged with construction of the CMS detector. A hierarchy of milestones has been adopted to aid project tracking. CMS has initiated a series of Engineering Design Reviews, wherein subsystems must address design and safety issues prior to procurement of major items of the detector.

U.S. CMS - The U.S. CMS project is making good progress and is approximately 29% complete. Schedule acceleration is a high priority. Cost experience on material contracts is good. Progress can be summarized as follows:

- Cost experience on endcap steel, HCAL scintillator and absorber, endcap muon (EMU) G10 insulator sheets, and ECAL transducer has been uniformly good.
- Engineering design reviews have been completed prior to major procurements for HCAL, EMU, and the magnet.
- Beam tests on major subsystems have been completed.
- Sufficient engineering has gone into the design of the U.S. CMS subsystems that the cost estimates are reliable and the schedule can be advanced.
- Production facilities for HCAL scintillator and EMU cathode strip chambers are in place.
- Work accomplished is approximately 90% of work planned.

5.2 U.S LHC ACCELERATOR

A quarterly status meeting was held in January. The project is making good progress and is approximately 29% complete. The quench performance of the most recent interaction region quadrupole model magnet showed great improvement over previous models. Additional model magnets were added to the R&D program. Recent accomplishments are summarized below:

Interaction Region (IR) Quadrupoles

- Completed an external technical review of the IR quadrupole R&D program.
- Complete successful tests of model magnet number 5.
- Revised the R&D program to include additional model magnets.

Interaction Region Dipoles/RF Region Dipoles

- Released purchase orders for materials for the prototype magnets and tooling parts.
- Placed contracts with NEEW for cable that will use surplus SSC wire.

Interaction Region Feedboxes/Interaction Region Absorbers

- Prepared a revised cost estimate for the DFBX based on the conceptual design and completed a review of the new cost estimate.
- Continued design work on power leads and evaluated expected radiation levels.
- Completed a conceptual design review for the IR absorbers and submitted functional specifications for the absorbers to CERN.

Superconductor Testing/Cable Production Support

- Continued upgrades to the superconductor test facilities.
- Prepared spare measuring heads for delivery to CERN.

Accelerator Physics

- Evaluated the magnetic field performance of the KEK model quadrupole magnets.
- Began studies on beam-beam interactions and continued work on electron cloud effects.

5.3 CERN DIRECT PURCHASES

DOE is receiving invoices from CERN for their payments to U.S. vendors per the U.S.-CERN Agreement and Accelerator Protocol. The status of payments to CERN is shown in Table 5.2.

Table 5.2, CERN Direct Purchases

Contract Item	U.S. Company	Amount Paid in $k	Contract Value
Niobium-titanium alloy bars and niobium barrier sheets	Wah Chang	4,020 1,619 310 218	
Dipole outerlayer and quadrupole superconducting cable [587 km]	IGC Advanced Superconductors	1,151	
Totals		7,318	

6. FINANCIAL/COST STATUS AND PLANS

TOTAL PROJECT FUNDING PLAN (then year millions of dollars)*

Fiscal Year	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	Total
Machine Funding Profiles (DOE)											
US LHC Accelerator	2.00	6.67	14.00	15.40	20.10	17.80	17.00	10.20	6.83	0.00	110.00
CERN Direct	0.00	0.00	0.00	14.34	11.10	14.26	14.20	18.80	17.30	0.00	90.00
Machine Total	2.00	6.67	14.00	29.74	31.20	32.06	31.20	29.00	24.13	0.00	200.00
Detector Funding Profiles (DOE and NSF)											
US ATLAS	1.70	3.71	10.05	27.83	27.44	27.59	27.85	22.89	14.69	0.00	163.75
DOE	1.70	3.71	10.05	11.20	15.50	15.30	15.20	15.60	14.69	0.00	102.95
NSF	0.00	0.00	0.00	16.63	11.94	12.29	12.65	7.29	0.00	0.00	60.80
US CMS	2.30	4.62	10.95	29.58	27.26	26.72	27.81	22.83	15.18	0.00	167.25
DOE	2.30	4.62	10.95	24.06	23.30	22.64	23.60	20.40	15.18	0.00	147.05
NSF	0.00	0.00	0.00	5.52	3.96	4.08	4.21	2.43	0.00	0.00	20.20
Detectors Total	4.00	8.33	21.00	57.41	54.70	54.31	55.66	45.72	29.87	0.00	331.00

FUNDS, COSTS, & COMMITMENTS (cumulative in thousands of dollars)†

Project Element	A = Funds Allocated‡	B = Actual Costs	C = Open Commit.	D= B+C Total	A –D= Funds Available
U.S. ATLAS	43,290	14,491	1,738	16,229	27,061
U.S. CMS	47,450	19,744	21,759	41,503	5,947
U.S. LHC Accelerator	38,070	23,684	2,956	26,640	11,430
CERN Direct Purchases	14,340	7,318	0	7,318	7,022
U.S. LHC Total	143,150	65,237	26,453	91,690	51,460

COST AND SCHEDULE STATUS PERFORMANCE REPORT (thousands of dollars)

	Cumulative Costs to Date					At Completion		
	Budgeted Cost			Variance			Revised	
	Work Scheduled	Work Performed	Actual Cost	Schedule	Cost	Budgeted	Estimate	Variance
U.S. ATLAS	17,525	14,955	14,791	(2,567)	164	163,750	163,750	0
U.S. CMS	41,498	39,188	19,744	(2,310)	19,444§	167,250	167,250	0
U.S. LHC Accelerator	30,218	26,692	26,628	(3,525)	65	110,000	110,000	0
CERN Invoices	7,100	7,100	7,100	0	0	90,000	90,000	0
U.S. LHC Total	96,341	87,935	68,263	(8,402)	19,673	531,000	531,000	0

* The annual funding distribution for the U.S. LHC projects is subject to change. Most of the changes are the result of reduced requirements for CERN direct purchases in FY 1999.

† The figures are based on financial reports from the U.S. ATLAS, CMS, and LHC Accelerator projects.

‡ NSF funding for FY 1999 was authorized this quarter for the U.S. ATLAS and U.S. CMS projects. This funding will be obligated in FY 1999 and FY 2000.

§ The large positive cost variance reported for U.S. CMS is due to delays in the submission of university invoices.

DOE/NSF COST BASELINE (in thousands of dollars)

U.S. ATLAS Cost Baseline

WBS No.	Description	Original	Change	Current
1.1	Silicon System	15,963	172	16,135
1.2	Transition Radiation Tracker	7,357	20	7,377
1.3	Liquid Argon Calorimeter	34,922	(2,437)	32,485
1.4	Tile Calorimeter	6,576	(112)	6,464
1.5	Muon Spectrometer	17,928	247	18,175
1.6	Trigger/Data Acquisition System	13,245	134	13,379
1.7	Common Projects	8,089	0	8,089
1.8	Education	270	(19)	251
1.9	Project Management	6,863	(180)	6,683
	Contingency	35,988	2175	38,163
	Total in FY 1997 dollars	147,201	0	147,201
	Escalation (FY 1997 to as spent $)	16,549	0	16,549
	U.S. ATLAS Total Cost Baseline	163,750	0	163,750

U.S. CMS Cost Baseline

WBS No.	Description	Original	Change	Current
1.1	Endcap Muon	26,206	0	26,206
1.2	Hadron Calorimeter	30,736	0	30,736
1.3	Trigger and Data Acquisition	12,382	0	12,382
1.4	Electromagnetic Calorimeter	7,969	0	7,969
1.5	Forward Pixels	5,176	0	5,176
1.6	Common Projects	23,874	0	23,874
1.7	Project Office	5,445	0	5,445
	Contingency	48,543	0	48,543
	FY 1996 & FY 1997 Expenditures	6,920	0	6,920
	U.S. CMS Total Cost Baseline	167,250	0	167,250

U.S. LHC Accelerator Cost Baseline*

WBS No.	Description	Original	Change	Current
1.1	Interaction Region Components	44,741	2,037	46,778
1.2	Radio Frequency Straight Section	13,492	0	13,492
1.3	Superconducting Wire and Cable	11,352	0	11,352
1.4	Accelerator Physics	4,925	0	4,925
1.5	Project Management	14,907	0	14,907
	Total in as spent $	89,417	(2,038)	91,455
	Contingency	20,583	(2,038)	18,545
	U.S. LHC Accelerator Total Cost Baseline	110,000	0	110,000

* The current baseline addresses the conversion from FY 1997 to then year dollars.

7. SCHEDULE STATUS AND PLANS

U.S. ATLAS Baseline Milestones (through 2001+)

WBS Identifiers	Milestone Description	Baseline Date	Forecast (F)/ Actual (A)
1	Project Start	10/01/95	10/01/95 (A)
	Project Completion	09/30/05	09/30/05 (F)
Tile Cal	Start Submodule Procurement	09/01/97	09/01/97 (A)
Tile Cal	Technology Choice for F/E Electronics	11/15/97	11/15/97 (A)
LarCal	Cryostat Contract Award	07/24/98	08/05/98 (A)
LarCal	Barrel Feedthroughs Final Design Review	09/30/98	10/02/98 (A)
LarCal	FCAL Mechanical Design Review	12/14/98	04/01/99 (F)
TRT	Mechanical Design Frozen	12/31/98	12/07/98 (A)
Muon	Start MDT Chambers Lines 1 and 2	01/04/99	12/13/99 (F)
Tile Cal	Start Module Construction	05/01/99	05/01/99 (F)
LarCal	Start Electronics Production (Preamps)	06/01/99	11/01/99 (F)
Muon	Start CSC Chamber Production	07/01/99	11/15/99 (F)
Tile Cal	Start Production Motherboards & Digitizer boards	07/02/99	07/02/99 (F)
Silicon	Start Full Strip Module Production	10/15/99	06/05/01 (F)
Muon	ASD Chip Design Complete	10/29/99	10/29/99 (F)
LarCal	FE Board SCA Production Chip Submission	11/01/99	07/03/00 (F)
Tri/DAQ	Select Final LVL2 Architecture	12/31/99	06/30/99 (F)
LarCal	Level 1 Trigger Final Design Complete	03/01/00	03/01/00 (F)
Silicon	ROD Design Complete	04/14/00	11/22/00 (F)
Muon	Final Design Global Alignment Devices Complete	04/28/00	04/28/00 (F)
LarCal	ROD Final Design Complete	06/01/00	06/01/00 (F)
Muon	CSC IC Production Complete	06/30/00	06/30/00 (F)
TRT	Select Final Electrical Design	07/31/00	07/31/00 (F)
TRT	Start Production (Electrical)	07/31/00	01/10/01 (F)
LarCal	Motherboard System Production Complete	01/01/01	01/01/01 (F)
Muon	MDT Supports,Mounts,Connect. Design Complete	01/30/01	01/30/01 (F)
Silicon	Start Full Silicon Strip Electronics Production	03/30/01	03/30/01 (F)
LarCal	Cryostat Arrives at CERN	03/30/01	03/30/01 (F)
LarCal	Barrel Feedthroughs Production Complete	07/18/01	07/18/01 (F)
LarCal	FCAL-C Delivered to EC	09/03/01	09/03/01 (F)
Tri/DAQ	LVL2 Trigger Design Complete	12/31/01	12/31/01 (F)
Tri/DAQ	LVL2 Trigger Development/Prototype Complete	12/31/01	09/30/01 (F)
Tri/DAQ	Start Production	01/08/02	01/08/02 (F)
Tri/DAQ	Start Installation and Commissioning	03/05/02	03/05/02 (F)
TRT	Module Production Complete	03/29/02	06/03/02 (F)
Tile Cal	Start Installation at CERN	06/01/02	06/01/02 (F)
LarCal	FCAL-A Delivered to EC	11/01/02	03/03/03 (F)

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U.S. CMS Baseline Milestones

WBS Identifiers	Milestone Description	Baseline Date	Forecast (F)/ Actual (A)
1	DOE/NSF CERN Agreement	12/97	12/08/98 (A)
	Approve Baseline	07/98	10/19/98 (A)
	Approve Project Management Plan	09/98	12/01/98 (A)
	U.S. CMS Project Complete	10/05	09/30/05 (F)
CP	Move 2nd Year Funding - Common Package (CP) A	10/98	01/99 (A)
EMU	Muon Cathode Strip Chamber (CSC) Factory Start	01/99	01/99 (A)
HCAL	HCAL Optics Factory Start	01/99	01/99 (A)
HCAL	1st 18 Wedges Optics @ CERN	06/00	06/00 (F)
HCAL	1st 18 Wedges HCAL Brass @ CERN	11/00	11/00 (F)
FPIX	Forward Pix Cooling Distribution Design Complete	01/01	01/01 (F)
CP	4th Year CP Package A Payment Complete	06/01	06/01 (F)
EMU	1st 17 Endcap Muon CSC Chambers Complete	06/01	06/01 (F)
HCAL	Finish Production Brass Wedges @ CERN	12/01	12/01 (F)
HCAL	Finish Production Optical System @ CERN	12/01	12/01 (F)
HCAL	HCAL Electronics Complete	01/02	01/02 (F)
ECAL	Final Production ECAL Serializer Wafer	02/02	02/02 (F)
TriDAS	Trigger MPC Board Assembly Complete	01/03	01/03 (F)
Inst	Start CMS Installation in Pit	01/03	01/03 (F)
CP	HE + YE + Connect	01/03	01/03 (F)
CP	HB in Vacuum Tank Test	03/03	03/03 (F)
CP	HE - YE – Connect	05/03	05/03 (F)
EMU	1st Half CSC Assembly at CERN Complete	07/03	07/03 (F)
TriDAS	Data Acquisition Event Manager Boards Complete	08/03	08/03 (F)
CP	Magnet Full Field Test Completed @ CERN	09/03	09/03 (F)
Inst	BO Underground Counting House	09/03	09/03 (F)
ECAL	Complete Production of Avalanche Photodiodes	09/03	09/03 (F)
Inst	Install Magnet in Collision Hall	10/03	10/03 (F)
EMU	All ME234/2 Assembled & Tested	10/03	10/03 (F)
EMU	EMU Electronics Complete	12/03	12/03 (F)
ECAL	Forward Pixels Shipped to CERN	09/04	09/04 (F)
All	U.S. CMS Construction Complete	09/04	09/04 (F)

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U.S. LHC Accelerator Baseline Milestones (through 2002+)

WBS Identifiers	Milestone Description	Baseline Date	Forecast (F)/ Actual (A)
1	Project Start	10/01/95	10/01/95 (A)
	Decision on RF Region Quadrupoles	07/01/01	07/01/01 (F)
	Project Completion	09/30/05	09/30/05 (F)
IR Region	Begin 1st Inner Triplet Quadrupole Model Magnet	07/01/97	07/01/97 (A)
SC	All Cable Production Support Equipment Delivered to CERN	**09/01/99***	**09/01/99 (F)**
IR Region	Complete Inner Triplet Quadrupole Model Magnet Program Phase 1	**12/01/99**	**12/01/99 (F)**
SC	Complete Superconductor Test Facility Upgrades	06/01/99	06/01/99 (F)
RF Region	Begin Assembly of 1st Dipole Model Magnet	09/01/99	09/01/99 (F)
IR Region	Complete Inner Triplet Quadrupole Model Magnet Program Phase 2	**03/01/00**	**03/01/00 (F)**
IR Region	Place Purchase Order for HTS Power Leads	**02/01/00**	**02/01/00 (F)**
RF Region	Complete Dipole Model Magnet Program	08/01/00	08/01/00 (F)
RF Region	Begin RF Region Dipole Production Assembly	09/01/00	09/01/00 (F)
IR Region	Begin Absorber Fabrication	11/01/00	11/01/00 (F)
IR Region	Complete Inner Triplet Quadrupole Prototype Magnet Program	12/01/00	12/01/00 (F)
IR Region	Begin Interaction Region Beam Separation Dipole Production Assembly	03/01/01	03/01/01 (F)
IR Region	Begin Inner Triplet Feedbox Fabrication	03/01/01	03/01/01 (F)
IR Region	Begin Inner Triplet Quadrupole Production Assembly	04/15/01	04/15/01 (F)
IR Region	Complete 1st Inner Triplet Quadrupole Magnet	11/01/01	11/01/01 (F)
RF Region	Delivery of D3, D4 for IR4 right	01/01/02	01/01/02 (F)
IR Region	Delivery of D2 for IR8 Left	04/01/02	04/01/02 (F)
IR Region	Complete Inner Triplet Feedbox Fabrication	05/01/02	05/01/02 (F)
IR Region	Delivery of All Inner Triplet System Components for IR8 Left (MQX, DFBX, D1)	10/01/02	10/01/02 (F)
RF Region	Complete RF Region Dipole Production Assembly	10/01/02	10/01/02 (F)
IR Region	Delivery of D2 for IR5 Left	11/01/02	11/01/02 (F)
RF Region	Delivery of D3, D4 for IR4 left	11/01/02	11/01/02 (F)
IR Region	Complete Absorber Fabrication	12/01/02	12/01/02 (F)
IR Region	Delivery of All Inner Triplet System Components for IR8 Right (MQX, DFBX, D1)	01/01/03	01/01/03 (F)
IR Region	Delivery of D2 for IR8 Right	02/01/03	02/01/03 (F)
IR Region	Complete Interaction Region Dipole Production Assembly	03/01/03	03/01/03 (F)

* Bold items denote approved changes.

8. TECHNICAL BASELINE STATUS

U.S. ATLAS

The U.S. ATLAS collaboration defined a list of initial deliverables representing the U.S. contribution to ATLAS. This list was approved by the JOG in March 1998 and sent to the CERN Director of Research in April 1998. Additional deliverables have already been identified as potential future contributions, should cost performance permit. Reference the U.S. ATLAS Project Management Plan, Appendix 3, (Approved 3/18/98).

U.S. CMS

The U.S. CMS collaboration defined a list of deliverables representing the U.S. contribution to CMS. This list was sent to the CERN Director of Research in August 1998 and approved by the JOG in October 1998. Reference the U.S. CMS Project Management Plan, Appendix 2, (Approved 10/19/98).

U.S. LHC Machine

U.S. LHC Accelerator Project - The U.S. deliverables to CERN are defined in the Implementing Arrangement to the Accelerator Protocol. The Implementing Arrangement was signed by the CERN and U.S. signatories in July 1998. Reference the U.S. LHC Accelerator Project Management Plan, Annex II, (Approved 6/15/98).

CERN Direct Purchases - CERN will procure from U.S. industrial firms supplies required to construct the LHC accelerator. These supplies will include superconducting alloy, cable, insulation, and other materials.

9. BASELINE CHANGE ACTIVITY

Baseline Control Level	Baseline Change Description
Level 1, DOE/NSF Joint Oversight Group	No changes this quarter
Level 2, DOE/NSF Project Office	
U.S. ATLAS	10 changes approved this quarter.
U.S. CMS	None reported this quarter.
U.S. LHC Accelerator Project	3 changes approved this quarter.

U.S. ATLAS – A total of ten Level 2 changes were approved this quarter.

U.S. CMS – There were no Level 2 changes this quarter.

U.S. LHC Accelerator – There were three Level 2 changes to the cost baseline this quarter. Each of the changes related to the cost baseline for the Interaction Region with the most significant being the addition of three model magnets. The net result of the changes was a $2 M reduction in project contingency.

Project Manager's Quarterly Progress Report
2nd Quarter FY 1999

APPENDIX A - FUNDING BY INSTITUTION (in thousands of dollars)

	U.S. LHC Accelerator FY 1998	U.S. LHC Accelerator FY 1999
FNAL	4,304	5,320
BNL	3,999	5,750
LBNL	2,140	1,110
Reserve	0	3,220
Total	10,443	15,400

	U.S. CMS Total FY 1998				U.S. CMS Total FY 1999* (as of 5/99)			
	DOE				DOE			
Institution	Grant	Contract	NSF	Total	Grant	Contract	NSF	Total
FNAL	0	5,517	0	5,517	0	10,817	40	10,857
Faifield U.	0	29	0	29	0	0	0	0
U. of Maryland	90	65	0	155	0	133	131	264
Boston U.	0	32	0	32	0	[11]	0	11
Florida State U.	60	54	0	114	71	118	0	189
U. of Minnesota	60	95	0	155	161	452	0	613
U. of Iowa	77	62	0	139	20	5	0	25
U. of Rochester	127	1,159	0	1,286	262	485	0	747
Notre Dame	0	52	0	52	0	0	[44] 184	228
Purdue U.	38	135	0	173	[33] 15	[92] 74	0	214
U of Mississippi	46	100	0	146	68	91	0	159
U. of Florida	44	95	0	139	184	412	0	596
Ohio State U.	140	64	0	204	275	212	0	487
Carnegie M.	0	113	0	113	0	291	0	291
Rice U.	138	19	0	157	102	56	0	158
U. of Wisconsin	533	1,052	0	1,585	471	4,884	0	5,355
U. C. Davis	34	100	0	134	0	78	0	78
UCLA	150	87	0	237	249	173	0	422
U.C. Riverside	20	10	0	30	0	163	0	163
John Hopkins	0	29	0	29	0	0	[70]	70
Northwestern	0	59	0	59	5	26	0	31
Rutgers	0	13	0	13	0	0	34	34
Princeton	0	256	0	256	0	626	0	626
Caltech	0	148	0	148	0	458	0	458
U.C. San Diego	11	0	0	11	90	24	0	114
Northeastern	0	0	0	0	0	0	[250]3120	3,370
U. Ill. –Chicago	0	0	0	0	0	0	124	124
U. of Nebraska	0	0	0	0	0	0	24	24
MIT	0	37	0	37	15	67	0	82
Reserve	0	0	0	0	0	2,291	1,499	3,790
Total	1,568	9,382	0	10,950	2,021	22,039	5,520	29,580

* FY 1999 totals show all current plans. Allocations pending signed statements of work are shown in parenthesis.

APPENDIX A - FUNDING BY INSTITUTION (in thousands of dollars)

	U.S. ATLAS Total FY 1998				U.S. ATLAS Total FY 1999 (as of 5/99)			
	DOE				DOE			
Institution	Grant	Contract*	NSF	Total	Grant	Contract	NSF	Total
ANL	0	1,098	0	1,098	0	460	0	460
BNL	0	3,903	0	3,903	0	2,006	0	2,006
LBNL	0	633	0	633	0	421	0	421
SUNY/Albany	20	0	0	20	0	0	0	0
U. of Arizona	320	100	0	420	634	0	0	634
Boston U.	224	0	0	224	298	0	0	298
Brandeis U.	265	45	0	310	0	0	0	0
U.C. Irvine	193	0	0	193	0	0	0	0
U.C. SantaCruz	404	0	0	404	0	0	0	0
U. of Chicago	0	54	0	54	0	0	0	0
Duke University	190	0	0	190	507	0	0	507
Hampton U.	0	0	0	0	0	0	0	0
Harvard	234	0	0	234	0	0	0	0
U. of Illinois	50	159	0	209	0	0	0	0
Indiana U.	190	0	0	190	640	0	0	640
MIT	50	0	0	50	105	0	0	105
Michigan State	0	35	0	35	0	0	0	0
Nevis/Columbia	0	675	0	675	0	0	0	0
U. of New Mex.	20	0	0	20	30	0	0	30
Northern Illinois	0	0	0	0	0	0	0	0
Ohio State U.	0	0	0	0	100	0	0	100
U. of Michigan	62	254	0	316	0	0	0	0
U. of Oklahoma	30	0	0	30	0	0	0	0
U. of Penn.	250	0	0	250	300	0	0	300
U. of Pittsburg	110	0	0	110	0	0	0	0
U. of Rochester	0	0	0	0	0	0	0	0
U.T. Arlington	50	82	0	132	0	0	0	0
South.Methodist	40	0	0	40	124	0	0	124
SUNY/Stony B.	27	0	0	27	0	0	0	0
Tufts University	50	0	0	50	20	0	0	20
U. Washington	0	0	0	0	0	0	0	0
U. of Wisconsin	230	0	0	230	311	0	0	311
Total	3,009	7,038	0	10,047	3,069	3,087	0	6,156
Reserve	0	3	0	3	0	5,044	16,630	21,674
Total	3,009	7,041	0	10,050	3,069	8,131	16,630	27,830

* Contract reflects DOE funding provided to BNL.